Bay Area Air Quality Management District

Draft Staff Report
April 2003

Appendix B

Existing BAAQMD Air Toxics NSR Program Risk Evaluation Procedure (REP) and Risk Management Policy (RMP)

Note: The RMP & REP will be replaced upon adoption of Regulation 2, Rule 5

Risk Evaluation Procedure

(Updated February 3, 2000)

This document describes the procedures to be followed by BAAQMD staff when evaluating health risks for permit applications involving the emission of toxic air contaminants (TACs).

I. All applications for authorities to construct or permits to operate new or modified sources shall be reviewed for emissions of TACs that may result in adverse health effects. The definitions of "new source" and "modified source" given in BAAQMD Regulation 2, Rule 2 shall be used, with the exception that the date of January 1, 1987 shall be used for determining applicability (rather than March 7, 1979).

II. The permit engineer shall identify all TACs emitted from new and modified sources to the extent necessary to determine whether or not they may pose a health risk. Contaminants to be considered are listed in Tables 1 and 2. If the applicant does not provide complete speciation of mixtures being used, the unspeciated fraction of any mixture will be assumed to be the most toxic compound consistent with the available description (e.g., "aromatic compounds" will be assumed to be benzene). The use of nonspecific material codes such as "Other Organic Compounds" or "Hydrocarbon---not specified" shall be avoided.

III. The permit engineer shall calculate annual emission rates for new sources, and the increase in annual emission rates for modified sources, for all emitted TACs listed in Tables 1 and 2. The emission calculation procedures for new and modified sources given in BAAQMD Regulation 2, Rule 2 shall be used. The calculated emission rates shall represent the operation of the source as it is to be described in the permit and any operating conditions associated with the permit.

IV. The total emissions of each applicable TAC from all new and modified sources contained within a permit application shall constitute the "project emissions" for the purpose of determining whether a risk analysis must be prepared. In addition, emission increases from all related projects at the facility shall be included in order to prevent circumvention which might be achieved by breaking a project into smaller pieces and submitting more than one permit application over a period of time. A "related project" shall include all new or modified sources at the facility that have been permitted within the two-year period immediately preceding the date a complete application is received, unless the permit applicant can demonstrate that the sources involved are not directly related to one another (e.g., installation of a groundwater stripper would be directly related to any other remedial activity already occurring, while construction of a new crude unit would not necessarily be directly related to the modernization of a wastewater treatment plant). A "related project" shall also include a series of consecutive modifications to a single source (e.g., increasing a source's permitted throughput), regardless of the time period over which the modifications occur.

V. A written risk analysis shall be prepared where the project emissions exceed any of the trigger levels listed in Tables 1 and 2. Permit applications not requiring a written risk analysis shall be judged to be in accordance with the BAAQMD's Risk Management Policy and will require no further review.

VI. At the permit engineer's request, staff of the Toxic Evaluation Section will prepare the risk analysis. The application shall not be deemed "complete" until all of the information necessary to perform the risk analysis has been collected. The application shall be forwarded to the Toxic Evaluation Section for review at least two weeks before a completeness determination must be made because additional information may need to be collected in order to perform or refine the analysis.

VII. The evaluating engineer has the option to prepare his/her own risk analysis, provided that it conforms to the procedures laid out in this document. Likewise, an applicant may also submit a conforming analysis. These analyses will be reviewed by the Toxic Evaluation Section for acceptability and amended, if necessary.

VIII. The risk analysis shall be performed in accordance with the risk assessment methodology established for use in the Air Toxics "Hot Spots" Program for estimating maximum individual cancer and chronic non-cancer health risks (ref.1, 2). The current adopted risk assessment guidelines shall be used based on the date of submittal of a complete permit application.

IX. A risk analysis may be performed at one of two levels or tiers. Level 1 is termed a "screening analysis" and Level 2 a "refined analysis". A screening analysis employs procedures and assumptions that assure a conservative estimate of public impact. A refined analysis employs procedures and assumptions that are more site-specific, resulting in a risk evaluation that is more representative of the source in question. The requirements for Level 1 and Level 2 analyses can be found in Appendix B.

X. The risk calculated in a Level 1 analysis tends to overestimate the real risk because of the conservative assumptions used in the process. This approach is satisfactory for the majority of sources and will be utilized routinely by the Toxic Evaluation Section in evaluating permit applications. There are situations, however, in which a Level 2 or refined analysis is preferable. These include the instance in which a screening analysis yields a risk value that exceeds levels given in the Risk Management Policy. In these cases a re-evaluation of the source using a refined analysis may result in a more realistic estimate of risk. The Toxic Evaluation Section will complete refined analyses where feasible, based upon available data and staff resources. The permit applicant also has the option of performing a refined analysis.

In other instances, certain sources/applications will benefit from an immediate Level 2 analysis. Among these are large facilities with multiple sources and/or pollutants, and applications from facilities that may engender public attention because of the nature of their operations or their location in the community. When these cases arise, the Toxic Evaluation Section will recommend that the applicant,

or a consultant hired by the applicant, prepare a Level 2 risk analysis. The Toxic Evaluation staff will be available to the applicant or the applicant's consultant to provide oversight in the preparation of the analysis.

XI. All risk analyses shall be reviewed by the Manager of the Toxic Evaluation Section, the District Toxicologist, or another staff member to which this responsibility has been delegated. This review serves the purpose of ensuring that the risk analysis conforms to BAAQMD requirements and that the Risk Management Policy has been followed. This review does not supercede current procedures governing other elements of permit review, such as compliance determination or New Source Review.

XII. It shall be the responsibility of the permit engineer to establish TBACT when required by the Risk Management Policy. The permit engineer shall consult the BACT/TBACT Handbook (ref. 3) for established sources. If TBACT has not been established for the sources being evaluated, the permit engineer shall be responsible for performing a TBACT determination. The Toxic Evaluation Section will be available to assist in the evaluation, if necessary.

Table 1
BAAQMD Screening Levels for Carcinogens
(Updated February 3, 2000)

Compound	Acceptable Emission Rate (lb/year)	Acceptable Air Concentration (gm/m^3)	Unit Risk Factor	Reference
Acetaldehyde	7.2E+01	3.7E-07	2.7E-06	1
Acetamide	9.7E+00	5.0E-08	2.0E-05	4
Acrylamide	1.5E-01	7.7E-10	1.3E-03	2
Acrylonitrile	6.7E-01	3.4E-09	2.9E-04	3
Allyl chloride	3.3E+01	1.7E-07	6.0E-06	3
2-Aminoanthraquinone	2.1E+01	1.1E-07	9.4E-06	4
Aniline	1.2E+02	6.3E-07	1.6E-06	2
Arsenic (inorganic)	2.5E-02♦	1.3E-10♦	3.3E-03	1
Asbestos	3.0E-03	1.6E-11	@@@	1
Benzene	6.7E+00	3.5E-08	2.9E-05	1
Benzidine	1.4E-03	7.1E-12	1.4E-01	3
Benzyl chloride	3.9E+00	2.0E-08	4.9E-05	2
Beryllium	1.4E-02♦	7.4E-11♦	2.4E-03	2
Bis(2-chloro-ethyl)ether	2.7E-01	1.4E-09	7.1E-04	3
Bis(chloro-methyl)ether	1.5E-02	7.7E-11	1.3E-02	3
1,3-Butadiene	1.1E+00	5.9E-09	1.7E-04	1
Cadmium (and compounds)	4.6E-02	2.4E-10	4.2E-03	1
Carbon tetrachloride	4.6E+00	2.4E-08	4.2E-05	1
Chlorinated dibenzodioxins and furans ##	1.2E-06♦	6.2E-15♦	3.8E+01	1
Chlorinated paraffins	7.7E+00	4.0E-08	2.5E-05	4
Chloroform	3.6E+01	1.9E-07	5.3E-06	1
4-Chloro-o-phenylenediamine	4.2E+01	2.2E-07	4.6E-06	4
p-Chloro-o-toluidine	2.5E+00	1.3E-08	7.7E-05	4
Chromium (hexavalent)	1.3E-03	6.7E-12	1.5E-01	1
p-Cresidine	4.4E+00	2.3E-08	4.3E-05	4
Cupferron	3.1+00	1.6E-08	6.3E-05	4
2,4-Diaminoanisole	2.9E+01	1.5E-07	6.6E-06	4
2,4-Diaminotoluene	1.8E-01	9.1E-10	1.1E-03	4
1,2-Dibromo-3-chloropropane	9.7E-02	5.0E-10	2.0E-03	3

Table 1
BAAQMD Screening Levels for Carcinogens
(Updated February 3, 2000)

Compound	Acceptable Emission Rate (lb/year)	Acceptable Air Concentration (gm/m^3)	Unit Risk Factor	Reference
1,4-Dichlorobenzene	1.8E+01	9.1E-08	1.1E-05	3
3, 3′-Dichlorobenzidine	5.6E-01	2.9E-09	3.4E-04	3
1,1-Dichloroethane	1.2E+02	6.3E-07	1.6E-06	4
Diesel exhaust particulate matter	6.4E-01	3.3E-09	3.0E-04	1
Diethylhexylphthalate	8.1E+01	4.2E-07	2.4E-06	5
p-Dimethylaminoazobenzene	1.5E-01	7.7E-10	1.3E-03	4
2,4-Dinitrotoluene	2.1E+00	1.1E-08	8.9E-05	3
1,4-Dioxane	2.5E+01	1.3E-07	7.7E-06	3
Epichlorohydrin	8.3E+00	4.3E-08	2.3E-05	3
Ethylene dibromide	2.7E+00	1.4E-08	7.1E-05	1
Ethylene dichloride	8.7E+00	4.5E-08	2.2E-05	1
Ethylene oxide	2.1E+00	1.1E-08	8.8E-05	1
Ethylenethiourea	1.5E+01	7.7E-08	1.3E-05	4
Formaldehyde	3.3E+01	1.7E--07	6.0E-06	1
Hexachlorobenzene	3.9E-01	2.0E-09	5.1E-04	3
Hexachlorocyclohexanes	1.8E-01	9.1E-10	1.1E-03	3
Hydrazine	3.9E-02	2.0E-10	4.9E-03	2
Lead and lead compounds	1.6E+01	8.3E-08	1.2E-05	1
4.4′-Methylenebis-(2-chloroaniline)	4.4E-01	2.3E-09	4.3E-04	4
Methylene chloride	1.9E+02	1.0E-06	1.0E-06	1
4,4′-Methylenedianiline	4.2E-01	2.2E-09	4.6E-04	4
Michler’s ketone	7.7E-01	4.0E-09	2.5E-04	4
Nickel and Nickel Compounds	7.3E-01	3.8E-09	2.6E-04	1
N-Nitrosodiethylamine	1.9E-02	1.0E-10	1.0E-02	3
N-Nitrosodimethylamine	4.2E-02	2.2E-10	4.6E-03	3
N-Nitrosodiphenylamine	7.3E+01	3.8E-07	2.6E-06	3
p-Nitrosodiphenylamine	3.1E+01	1.6E-07	6.3E-06	4
N-Nitroso-n-dibutylamine	1.6E-03	9.1E-12	1.1E-01	3
N-Nitroso-N-methylethylamine	3.1E-02	1.6E-10	6.3E-03	2
N-Nitrosomorpholine	1.0E-01	5.3E-10	1.9E-03	4

Table 1
BAAQMD Screening Levels for Carcinogens
(Updated February 3, 2000)

Compound	Acceptable Emission Rate (lb/year)	Acceptable Air Concentration (gm/m^3)	Unit Risk Factor	Reference
N-Nitrosopiperidine	7.1E-02	3.7E-10	2.7E-03	4
N-Nitrosodi-*n*-propylamine	9.7E-02	5.0E-10	2.0E-03	2
N-Nitrosopyrrolidine	3.3E-01	1.7E-09	6.0E-04	2
PAHs ***	4.4E-02♦	2.3E-10♦	1.7E-03	1
PCBs	6.8E-03♦	3.5E-11♦	2.2E-03	3
Pentachlorophenol	3.8E+01	2.0E-07	5.1E-06	3
Perchloroethylene	3.3E+01	1.7E-07	5.9E-06	1
Potassium bromate	1.4E+00	7.1E-09	1.4E-04	4
1,3-Propane sultone	2.7E-01	1.4E-09	6.9E-04	4
Propylene oxide	5.2E+01	2.7E-07	3.7E-06	2
1,1,2,2-Tetrachloroethane	3.3E+00	1.7E-08	5.8E-05	2
Thioacetamide	1.1E-01	5.9E-10	1.7E-03	4
2,4- and 2,6-Toluene diisocyanate	1.8E+01	9.1E-08	1.1E-05	4
1,1,2-Trichloroethane	1.2E+01	6.3E-08	1.6E-05	2
Trichloroethylene	9.7E+01	5.0E-07	2.0E-06	1
2,4,6-Trichlorophenol	9.7E+00	5.0E-08	2.0E-05	3
Urethane	6.6E-01	3.4E-09	2.9E-04	3
Vinyl chloride	2.5E+00	1.3E-08	7.8E-05	1

Footnotes for Table 1

Expressed as 2,3,7,8-TCDD equivalents.

*** Includes, but is not limited to, benz[a]anthracene, benzo[a]pyrene, benzo[k]fluoroanthene, benzo[b]fluoroanthene, dibenz[a,h]anthracene, indeno[1,2,3-cd]ppyrene.

♦ Screening levels adjusted to include the impact from default noninhalation pathways.

@@@ URF = 1.9E-04/100 fibers/m^3. Use factor of 100 fibers/0.003 μg weight to convert asbestos concentration in $\mu g/m^3$ to fibers/m^3.

Notes for Table 1

The acceptable air concentration (g/m^3) is the annual average air concentration which would cause a cancer risk of 1E-06 (one in a million). These concentrations are converted to an emission rate (lb/year) by use of the following aerodynamic downwash equation (ref. 6):

Emission rate (g/sec) = 1-hour average concentration (g/m^3) x 1.5 x A x u

Assuming:

1-hour average concentration = annual average concentration x 10 (ref. 7)
A = building cross-sectional area = 92.7 m^2 (25'h x 40'w) [reasonable worst-case assumption]
u = wind speed = 2 m/sec (ref. 8)
Emission rate (lb/year) = emission rate (g/sec) x 69525 (lb/yr)/(g/sec) [units conversion]

Substituting:

Emission rate (lb/year) = [annual avg. concentration (g/m^3) x 10] x [69525 (lb/yr)/(g/s)] x [1.5 x 92.7 m^2 x 2 m/sec]

Yields:

Emission rate (lb/year) = annual average concentration (g/m^3) x 1.93E+08

References for Table 1

1. California/EPA Office of Environmental Health Hazard Assessment (OEHHA), *Air Toxics Hot Spots Program Risk Assessment Guidelines. Part II: Technical Support Document for Describing Available Cancer Potency Factors, April 1999*, Toxic Air Contaminant document.

2. California/EPA Office of Environmental Health Hazard Assessment (OEHHA), *Air Toxics Hot Spots Program Risk Assessment Guidelines. Part II: Technical Support Document for Describing Available Cancer Potency Factors, April 1999*, Integrated Risk Information System (IRIS), US EPA.

3. California/EPA Office of Environmental Health Hazard Assessment (OEHHA), *Air Toxics Hot Spots Program Risk Assessment Guidelines. Part II: Technical Support Document for Describing Available Cancer Potency Factors, April 1999*, Standard Proposition 65 document.

4. California/EPA Office of Environmental Health Hazard Assessment (OEHHA), *Air Toxics Hot Spots Program Risk Assessment Guidelines. Part II: Technical Support Document for Describing Available Cancer Potency Factors, April 1999*, Expedited Proposition 65 document.

5. California/EPA Office of Environmental Health Hazard Assessment (OEHHA), *Air Toxics Hot Spots Program Risk Assessment Guidelines. Part II: Technical Support Document for Describing Available Cancer Potency Factors, April 1999,* Pesticide and Environmental Toxicology Section document.

6. USEPA, Office of Air Quality Planning and Standards, *Screen3 Model User's Guide*, EPA-454/B-95-004, September 1995.

7. USEPA, Office of Air Quality Planning and Standards, *Screening Procedures for Estimating the Air Quality Impact of Stationary Sources, Revised*, EPA-454/R-92-019, October 1992.

8. USEPA, Office of Air Quality Planning and Standards, *Regional Workshops on Air Quality Modeling: A Summary Report*, EPA-450/4-82-015, 1982.

Table 2
BAAQMD Screening Levels for Noncarcinogens
(Updated February 3, 2000)

Compound	Acceptable Emission Rate (lb/year)	Acceptable Air Concentration (g/m^3)	Reference
Acrolein	3.9E+00	2.0E-08	2
Allyl chloride	1.9E+02	1E-06	2
Ammonia	1.9E+04	1E-04	2
Benzyl chloride	2.3E+03	1.2E-05	3
Bromine and compounds	3.3E+02	1.7E-06	3
Butyl alcohol, tert-	1.4E+05	7.1E-04	5
Carbon disulfide	1.4E+04	7.4E-05	5
Chlorine	1.4E+03	7.1E-06	3
Chlorobenzene	1.4E+04	7.0E-05	2
Chlorofluorocarbons	1.4E+05	7.0E-04	2
Chlorophenol, 2-	3.5E+03	1.8E-05	2
Chloropicrin	7.7E+02	4.0E-06	3
Chlorotoluene	2.3E+03	1.2E-05	5
Copper and copper compounds	4.6E+02	2.4E-06	3
Cresol mixtures	3.5E+04	1.8E-04	2
1,1-Dichloroethylene; *see* Vinylidene chloride			
Diethylaminoethanol	2.1E+04	1.1E-04	5
Dimethylamine	3.8E+02	2.0E-06	2
Dimethyl phthalate	2.3E+03	1.2E-05	5
Dioctyl phthalate	2.3E+03	1.2E-05	5
Ethyl alcohol (ethanol)	8.7E+05	4.5E-03	5
Ethyl acetate	6.6E+05	3.4E+03	5
Ethyl acrylate	9.3E+03	4.8E-05	3
Ethyl chloride	1.9E+06	1.0E-02	2
Freons: *see* Chlorofluorocarbons			
Gasoline vapors	4.1E+05	2.1E-03	3
Glutaraldehyde	3.3E+02	1.7E-06	3
Glycol ethers:			
2-ethoxyethanol (Cellosolve®)	3.9E+04	2.0E-04	2

Table 2
BAAQMD Screening Levels for Noncarcinogens
(Updated February 3, 2000)

Compound	Acceptable Emission Rate (lb/year)	Acceptable Air Concentration (g/m^3)	Reference
2-ethoxyethanol acetate (Cellosolve® acetate)	1.2E+04	6.4E-05	3
2-methoxymethanol (Methyl Cellosolve®)	3.9E+03	2.0E-05	2
2-methoxymethanol acetate (Methyl Cellosolve® acetate)	1.1E+04	5.7E-05	3
2-butoxyethanol (Butyl Cellosolve®)	3.9E+03	2.0E-05	4
Hexachlorocyclopentadiene	4.6E+01	2.4E-07	2,3
n-Hexane	8.3E+04	4.3E-04	5
Hydrogen bromide	4.6E+03	2.4E-05	3
Hydrogen chloride	1.4E+03	7.0E-06	2
Hydrogen cyanide	1.4E+04	7.0E-05	2
Hydrogen fluoride	1.1E+03	5.9E-06	3
Hydrogen sulfide	8.1E+03	4.2-05	6
Methylene-bis-phenylisocyanate	1.8+01	9.5E-08	3
Methyl isocyanate	7.0E+01	3.6E-07	3
Toluene diisocyanate	1.8+01	9.5E-08	3
Isophorone	6.6E+04	3.4E-04	5
Isopropyl alcohol	4.4E+05	2.3E-03	5
Lead, inorganic, and compounds	2.9E+01*	1.5E-07*	6
Maleic anhydride	4.6E+02	2.4E-06	3
Manganese and manganese compounds	7.7E+01	4.0E-07	2
Mercury and mercury compounds	5.8E+01	3.0E-07	4
Methyl alcohol	1.2E+05	6.2E-04	3
Methyl bromide	1.2E+03	6.0E-06	4
Methyl chloroform (TCA)	6.2E+04	3.2E-04	2
Methylene dianiline & chloride, 4,4'-	3.7E+02	1.9E-06	3
Methyl ethyl ketone	1.5E+05	7.7E-04	1
Methyl mercury	1.9E+02	1.0E-06	2
Methyl methacrylate	1.9E+05	1.0E-04	3
N-Methylpyrrolidone	1.8E+05	9.5E-04	5

Table 2
BAAQMD Screening Levels for Noncarcinogens
(Updated February 3, 2000)

Compound	Acceptable Emission Rate (lb/year)	Acceptable Air Concentration (g/m^3)	Reference
Naphthalene	2.7E+02	1.4E-05	4
Nitric acid	2.3E+03	1.4E-05	5
Nitrobenzene	3.3E+02	1.7E-06	2
Nitropropane, 2-	3.9E+03	2.0E-05	2
Phenol	8.7E+03	4.5E-05	3
Phosgene	1.8E+02	9.5E-07	5
Phosphine	1.9E+03	1.0E-05	2
Phosphoric acid	4.6E+02	2.4E-06	5
Phosphorus (white)	1.4E+01	7.0E-08	2
Phthalic anhydride	1.4E+06	7.0E-03	2
Selenium and selenium compounds	9.7E+01	5.0E-07	3
Silica, respirable, crystalline	2.3E+02	1.2E-06	3
Sodium hydroxide	9.3E+02	4.8E-06	3
Styrene monomer	1.4E+05	7.0E-04	2
Tetrachlorophenols	1.7E+04	8.8E-05	2
Tetrahydrofuran	2.7E+05	1.4E-03	5
Toluene	3.9E+04	2.0E-04	2
Trichlorobenzene, 1,2,4-	1.8E+04	9.5E-05	5
1,1,1-Trichloroethane; *see* Methyl chloroform			
Vapam (Na diethyldithiocarbamate)	2.2E+04	1.1E-04	1
Vinylidine chloride (1,1-Dichloroethylene)	6.2E+03	3.2E-05	2
Xylenes	5.8E+04	3.0E-04	4
Zinc and zinc compounds	6.8E+03	3.5E-05	1

Footnote for Table 2

* Screening levels adjusted to include the impact from default noninhalation pathways

Notes for Table 2

The acceptable air concentration (g/m^3) is the annual average air concentration below which adverse non-cancer health effects are not expected to occur. These concentrations are converted to an emission rate (lb/year) by use of the following aerodynamic downwash equation (ref. 7):

Emission rate (g/sec) = 1-hour average concentration (g/m^3) x 1.5 x A x u

Assuming:

1-hour average concentration = annual average concentration x 10 (ref. 8)
A = building cross-sectional area = 92.7 m^2 (25'h x 40'w) [reasonable worst-case assumption]
u = wind speed = 2 m/sec (ref. 9)
Emission rate (lb/year) = emission rate (g/sec) x 69525 (lb/yr)/(g/sec) [units conversion]

Substituting:

Emission rate (lb/year) = [annual avg. concentration (g/m^3) x 10] x [69525 (lb/yr)/(g/s)] x [1.5 x 92.7 m^2 x 2 m/sec]

Yields:

Emission rate (lb/year) = annual average concentration (g/m^3) x 1.93E+08

References for Table 2

1. Acceptable Daily Intake; EPA Superfund Public Health Evaluation Manual, 1986.

2. California-EPA Office of Environmental Health Hazard Assessment, *CAPCOA Air Toxics "Hot Spots" Program Risk Assessment Guidelines, October 1993*, IRIS database.

3. California-EPA Office of Environmental Health Hazard Assessment, *CAPCOA Air Toxics "Hot Spots" Program Risk Assessment Guidelines, October 1993*, TLV/420.

4. California-EPA Office of Environmental Health Hazard Assessment, *CAPCOA Air Toxics "Hot Spots" Program Risk Assessment Guidelines, October 1993*, EPA Health Effects Assessment Summary Tables, Fourth Quarter FY 1991.

5. Threshold Limit Value (TLV)/Safety factor of 420.

6. California Ambient Air Quality Standard (CAAQS).

7. USEPA, Office of Air Quality Planning and Standards, *Screen3 Model User's Guide,* EPA-454/B-95-004, September 1995.

8. USEPA, Office of Air Quality Planning and Standards, *Screening Procedures for Estimating the Air Quality Impact of Stationary Sources, Revised*, EPA-454/R-92-019, October 1992.

9. USEPA, Office of Air Quality Planning and Standards, *Regional Workshops on Air Quality Modeling: A Summary Report*, EPA-450/4-82-015, 1982.

APPENDIX A
REFERENCES

The health risk assessment procedures used by the BAAQMD are in accordance with guidelines adopted by Cal/EPA, specifically the Office of Environmental Health Hazard Assessment (OEHHA), for the Air Toxics "Hot Spots" Program. These guidelines, which are prepared in coordination with the California Air Resources Board (CARB) and the California Air Pollution Control Officers Association (CAPCOA), have been revised several times and are subject to future updating. The current adopted risk assessment guidelines are listed in reference numbers 1 and 2 below.

References:

1. California Air Pollution Control Officers Association, *CAPCOA Air Toxics "Hot Spots" Program, Revised 1992 Risk Assessment Guidelines*, October 1993.

2. Cal/EPA Office of Environmental Health Hazard Assessment Memorandum, *Adoption of Cancer Potency Values for Airborne Toxicants*, April 13, 1999.

3. BACT/TBACT Workbook: Guidelines for Best Available Control Technology including Best Available Control Technology for Toxics (TBACT), June 1995. Periodic updates to Workbook found on the BAAQMD website (www.baaqmd.gov).

APPENDIX B
RISK ANALYSIS PROCEDURES

The Air Toxic "Hot Spots" (ATHS) Program risk assessment guidelines contain detailed discussions on the nature of risk assessments and their preparation. Anyone preparing a risk evaluation for submission to the BAAQMD should consult these guidelines. [It should be noted, however, that the ATHS program involves estimating health risks associated with TAC emissions from entire facilities. The BAAQMD review for new/modified sources involves estimating incremental health risks associated with increases in TAC emissions from proposed projects].

Procedures for Levels 1 and 2 Risk Analyses follow. It should be noted that the ATHS Program risk assessment guidelines use a tiered, iterative, approach to evaluating health risks to allow the level of effort in assessing risk to be commensurate with the importance of the risk management decision. Under this approach, additional detail and refinement in an analysis is introduced only to the extent necessary to reach specified acceptable risk levels.

1. Risk Screening Analysis (Level 1)

A. Components of a Screening Analysis

A screening analysis should contain the following:

1. A brief description of the new or modified source(s).

2. The annual emission estimates associated with the new or modified source(s) for all TACs listed in Tables 1 and 2.

3. A description of applicable emission release parameters such as stack height, stack diameter, stack gas velocity, and release temperature for point sources, or the characteristics of area or volume sources. For elevated emission releases, the dimensions of nearby buildings should also be provided for determining building downwash impacts.

4. The choice of air dispersion model; SCREEN3 or ISCST3 using default meteorological data (i.e., SCREEN3) are the models usually chosen. Any dispersion model selected must be EPA-approved and in the public domain.

5. Identification of the receptors to be impacted by the source being evaluated. This will typically include the closest residential receptor, the closest off-site industrial receptor and any K-12 schools within 1000 feet of the source.

6. The choice of exposure pathways to be evaluated. If the source being evaluated will emit volatile organic compounds (VOC) or other gaseous TACs only, the inhalation pathway is the only pathway that need be evaluated. If the source emits any of the contaminants listed in Table B-1, then noninhalation pathways must also be evaluated. The pathways to be included, in addition to inhalation, are soil ingestion, dermal exposure and mother's milk.

7. An estimate of the zone of impact of the proposed project, if requested by the Toxic Evaluation Section staff. The zone of impact is used to determine whether additional non-inhalation exposure pathways should be evaluated.

B. Results and Calculations

The following items should be included in this portion of the analysis:

1. The results of the air dispersion modeling expressed as the annual average ambient air concentration(s) resulting from the project's emissions ($\mu g/m^3$). The concentrations at the site of maximum impact and at the location of any of the receptors defined in A.6 should be clearly identified.

2. Calculations of risk attributable to emissions of carcinogens and/or calculations of hazard indices attributable to emissions of noncarcinogens. The risk should be calculated for the maximally exposed individual (MEI), which may be either a residential site, an offsite worker, or any K-12 schools within 1000 feet of the source. Sample calculations for risk and hazard index are shown in Appendix C.

   In those instances where noninhalation pathways are included, the risks from these exposure routes should be added to the inhalation risk to give total risk. Similarly, hazard indices are calculated for all of the pathways and summed to give a total hazard index.

3. An adequate map of the facility showing the location of sources, the facility boundary line, all pertinent receptors, and the facility zone of impact (if required).

2. Refined Risk Analysis (Level 2)

A. Components of a Refined Analysis

A refined analysis should contain the following:

1. A description of the new or modified source(s).

2. The annual emission estimates associated with the new or modified source(s) for all TACs listed in Tables 1 and 2.

3. A description of applicable emission release parameters such as stack height, stack diameter, stack gas velocity, and release temperature for point sources, or the characteristics of area or volume sources. For elevated emission releases, the dimensions of nearby buildings should also be provided for determining building downwash impacts.

4. The choice of air dispersion model(s); ISCST3 is the model usually chosen. The reasons for the choice of model should be listed. Any dispersion model selected must be EPA-approved and in the public domain.

5. The choice of meteorological data. The meteorological data must be deemed applicable for the site by BAAQMD meteorologists. For determining cancer risks, the results may be averaged if a minimum of three consecutive years of approved meteorological data is available.

6. The choice of exposure pathways to be evaluated. If the source being evaluated will emit volatile organic compounds (VOC) or other gaseous TACs only, the inhalation pathway is the only pathway that need be evaluated. If the source emits any of the contaminants listed in Table B-1, then noninhalation pathways must also be evaluated. The minimum pathways to be included, in addition to inhalation, are soil ingestion, dermal exposure and mother's milk. Any other pathways that are applicable within the zone of impact of the proposed project (e.g., fish consumption, crop consumption) must also be included.

7. A network of receptor points identified in the modeling analysis. The network should be of sufficient number and density to locate the site of maximum concentration. Receptor points should also be placed at the location of sensitive receptors such as K-12 schools. If required by the Toxic Evaluation Section, receptors should also include census tract (or sub-census area) centroids surrounding the source(s).

8. Identification of the receptors to be impacted by the source being evaluated. This should include the residential and off-site industrial receptors surrounding the source, any K-12 schools located within 1000 feet of the source.

9. An estimate of the zone of impact of the proposed project, if requested by the Toxic Evaluation Section staff. The zone of impact is used to determine whether additional non-inhalation exposure pathways should be evaluated. The zone of impact may also be used to determine which census tracts need to be included in estimating population risks, if deemed necessary by the Toxic Evaluation Section.

B. Results and Calculations

The following items should be included in this portion of the analysis:

1. The results of the air dispersion modeling expressed as the annual average ambient air concentration(s) ($\mu g/m^3$). The concentrations at the site of maximum impact and at the location of any of the receptors defined in A.8 should be clearly identified.

2. Calculations of risk attributable to emissions of carcinogens and/or calculations of hazard indices attributable to emissions of noncarcinogens. The calculations should include the risk to the maximally exposed individual (MEI) and the risks to all of the receptors identified in A.8. Sample calculations for risk and hazard index are shown in Appendix C.

   In those instances where noninhalation pathways are included, the risks from these exposure routes are added to the inhalation risk to give total risk. Similarly, hazard indices are calculated for all of the pathways. The indices for substances affecting the same target organ are summed to give total hazard indices for each target.

3. An adequate map of the facility showing the location of sources, the facility boundary line, all pertinent receptors, and the facility zone of impact (if required).

Table B-1

Substances to be Evaluated for Noninhalation Exposures

Arsenic	Mercury[1]	Polychlorinated biphenyls
Beryllium	Nitrosamines:	PAHs Including, but not limited to:
Cadmium[1]	N-Nitrosodiethylamine	Benz[a]anthracene
Chlorobenzene[1]	N-Nitrosodimethylamine	Benzo[b]fluoranthene
Chromium (hexavalent)	p-Nitrosodiphenylamine	Benzo[k]fluoranthene
Dioxins and Furans	N-Nitrosodi-n-butylamine	Benzo[a]pyrene
2-Chlorophenol[1]	N-Nitrosodi-n-propylamine	Dibenz[a,h]anthracene
p-Dichlorobenzene	N-Nitrosomethylethylamine	Indeno[1,2,3-cd]pyrene
Hexachlorobenzene	N-Nitrosomorpholine	Naphthalene[1]
Hexachlorocyclohexanes	N-Nitrosopiperidine	Pentachlorophenol
Lead[1]	N-Nitrosopyrrolidine	2,4,6 Trichlorophenol

[1] Oral cancer potency value not available.

APPENDIX C
SAMPLE CALCULATIONS

Sample calculations for risk from inhalation exposure only are presented here. Noninhalation exposure risks can be calculated using the equations found in the risk assessment guidelines. Software packages are also available through for estimating risk from both inhalation and noninhalation pathways. They are available through CARB and CAPCOA.

A. Calculation of carcinogenic risk (inhalation pathway)

1) Residential site, 70-year exposure:

Cancer Risk = maximum GLC x URF

2) Off-site worker, long-term exposure:

Cancer Risk = maximum GLC x URF x WEF

GLC = long-term average ground-level air concentration ($\mu g/m^3$)
URF = pollutant-specific unit risk factor $(\mu g/m^3)^{-1}$
WEF = worker exposure factor, long term (varies from 0.14 to 0.66)
If the source emissions occur continuously (i.e., 24 hours/day, 365 days/year), a WEF of 0.14 should be used (8/24 hr x 240/365 days x 46/70 years).
If the source emissions coincide with hours of operation for off-site workers. e.g. weekdays from 8:00 AM to 5:00 PM, rather than continuously, then a WEF of 0.66 should be used (46/70 years).

B. Calculation of noncarcinogenic chronic risk (inhalation pathway)

1) Residential site, long-term exposure:

Hazard Index = maximum GLC/inhalation REL

2) Off-site worker, long-term exposure:

Hazard Index = (maximum GLC/inhalation REL) x WEF

GLC = annual average ground-level air concentration ($\mu g/m^3$)
REL = inhalation reference exposure level ($\mu g/m^3$)
WEF = worker exposure factor, long term (0.22 to 1.0)
If the source emissions occur continuously (i.e., 24 hours/day, 365 days/year), a WEF of 0.22 should be used (8/24 hr x 240/365 days).
If the source emissions coincide with hours of operation for off-site workers. e.g. weekdays from 8:00 AM to 5:00 PM, rather than continuously, no exposure adjustments should be applied (WEF = 1.0).

Risk Management Policy

(Updated February 3, 2000)

The APCO is responsible for Risk Management at the BAAQMD. The APCO may consider a number of factors in determining whether to issue or deny a permit for a proposed project together with the results of a risk analysis. These factors include possible net air quality benefits of replacement equipment, incorporation of all feasible risk reduction measures, the lifetime of the project, the degree of uncertainty in the risk analysis, the costs of mitigation, project benefit to society, or any other relevant factor.

A. The APCO has determined that projects meeting one or more of the following three criteria are acceptable without further risk management consideration:
   i. The project is acceptable if the annual emissions associated with the project would result in an incremental cancer risk equal to or less than 1E-06 (one in a million), were the exposure to continue for 70 years. When applicable, the chronic noncancer risk associated with the project, expressed in terms of a Hazard Index, must be equal to or less than 1.0. The risk is calculated at the point of maximum residential or maximum off-site worker exposure, whichever is greater.
   ii. The project is acceptable if the annual emissions associated with the project would result in an incremental cancer risk greater than 1E-06 (one in a million) and equal to or less than 10E-06 (ten in a million), were the exposure to continue for 70 years, the chronic noncancer risk associated with the project, expressed in terms of a Hazard Index, is equal to or less than 1.0, and TBACT has been applied to permitted sources (TBACT is determined on a case-by-case basis and represents a level of control technology no less stringent than BACT for criteria pollutants; in some cases BACT and TBACT will be equivalent). The risk is calculated at the point of maximum residential or maximum off-site worker exposure, whichever is greater.
   iii. The project is acceptable if it meets any separate criteria for project approval that have been established by the APCO for specific source categories based on risk management considerations.

B. Permit applications not meeting one of the above criteria shall be routed to the APCO with a recommendation for denial. The permit engineer shall collect any additional information regarding the project requested by the APCO that will be considered in the risk management process.

Risk Management Policy for Perc Dry Cleaners

(Updated February 3, 2000)

This document summarizes criteria that have been established by the APCO for approval of permits for new/modified perchloroethylene dry cleaners. These criteria have been established under Section A(iii) of the District's Risk Management Policy based on risk management considerations, and do not supercede any other applicable District Rules and Regulations.

The APCO has determined that proposed projects involving perchloroethylene dry cleaners that meet one or more of the following three criteria are acceptable without further risk management considerations. Risks are to be calculated using the applicable Unit Risk Factor for perchloroethylene at the point of maximum residential or maximum off-site worker exposure, whichever is greater.

A. The project is acceptable if the annual emissions associated with the project would result in an incremental cancer risk equal to or less than 1.0E-06 (one in a million), were the exposure to continue for 70 years.

B. The project is acceptable if: (1) the annual emissions associated with the project would result in an incremental cancer risk greater than 1.0E-06 (one in a million) and equal to or less than 1.0E-05 (ten in a million), were the exposure to continue for 70 years; and (2) TBACT has been applied to permitted sources. TBACT for perchloroethylene dry cleaners is as follows:

   a) TBACT is a Secondary Control Machine for any new installation of a dry cleaning machine (including new facilities, replacement machines, additional machines at existing facilities) or for an increase in the permitted level of solvent emissions, except as follows in item b;

   b) TBACT is a Closed-loop Machine for a relocated machine (a relocation of an existing facility's machine to a new non-residential facility within the District is exempt from secondary control requirements in accordance with Regulation 11-16-104 and the BACT/TBACT Workbook).

C. The project is acceptable if: (1) the annual emissions associated with the project would result in an incremental cancer risk greater than 1.0E-05 (ten in a million) and equal to or less than 1.0E-04 (one hundred in a million), were the exposure to continue for 70 years; and (2) TBACT has been applied to permitted sources; and (3) all reasonable risk reduction measures have been applied. TBACT and all reasonable risk reduction measures for perchloroethylene dry cleaners are as follows:

a) TBACT is a Secondary Control Machine for any new installation of a dry cleaning machine (including new facilities, replacement machines, additional machines at existing facilities) or for an increase in the permitted level of solvent emissions, except as follows in item b;

b) TBACT is a Closed-loop Machine for a relocated machine (a relocation of an existing facility's machine to a new non-residential facility within the District is exempt from secondary control requirements in accordance with Regulation 11-16-104 and the BACT/TBACT Workbook).

c) All reasonable risk reduction measures are: (1) a Vapor Barrier Room (consistent with Regulation 11-16-307.1 and the Dry Cleaner Ventilation Guidelines) for a new facility (including a relocated facility); or (2) an enhanced ventilation system (consistent with Regulation 11-16-307.2 and the Dry Cleaner Ventilation Guidelines, i.e., Vapor Barrier Room, Vapor Capture Room, Partial Vapor Room, or Local Ventilation System) for a proposed project at an existing facility that is not co-residential.

A permit applicant may apply alternative and/or additional emissions control (e.g., secondary control retrofits for relocated machines, use of alternative solvents) or other risk reduction measures (e.g., increasing stack height and/or exit velocity) as necessary to reduce risks to acceptable levels specified in one of the three listed criteria above.

Permit applications not meeting one of the above criteria shall be routed to the APCO with a recommendation for denial. The permit engineer shall collect any additional information regarding the project requested by the APCO that will be considered in the risk management process.

Risk Management Policy for Diesel-Fueled Engines

(Updated January 11, 2002)

This document summarizes criteria that have been established by the APCO for approval of permits for new/modified diesel-fueled, reciprocating, engines ("diesel-fueled engines"). These criteria have been established under Section A(iii) of the District's Risk Management Policy based on risk management considerations, and do not supercede any other applicable District Rules and Regulations. Definitions of key terms used in this policy shall be consistent with those given in Risk Management Policy for Permitting of New Stationary Diesel-Fueled Engines, California Air Resources Board, October 2000.

The APCO has determined that proposed projects with permitted diesel-fueled engines meeting one or more of the following two criteria are acceptable without further risk management considerations. Risks are to be calculated using the applicable Unit Risk Factor for diesel particulate matter (PM) at the point of maximum residential or maximum off-site worker exposure, whichever is greater. For emergency standby engines, risks are to be calculated for all engine operation excluding emergency use (as defined in Regulation 9-8-231).

A. The project is acceptable if the annual emissions associated with the project would result in an incremental cancer risk equal to or less than 1.0E-06 (one in a million), were the exposure to continue for 70 years.

B. The project is acceptable if: (1) the annual emissions associated with the project would result in an incremental cancer risk greater than 1.0E-06 (one in a million) and equal to or less than 1.0E-05 (ten in a million), were the exposure to continue for 70 years; and (2) TBACT has been applied to permitted sources. TBACT for diesel-fueled engines is as follows:

   a) TBACT is a low emitting, spark-ignited, gas-fueled engine with lean burn combustion or rich burn with Non-Selective Catalytic Reduction (see District's *BACT/TBACT Workbook*). A diesel-fueled engine will be permitted only if a gas-fueled engine, or electric motor, is not practical (e.g., a remote location without natural gas availability or electric power, the engine is to be used exclusively for emergency standby purposes, or only a diesel-fueled engine will meet the portability and/or power/torque/rpm requirements of the application under review).

   b) If a diesel-fueled engine is shown by the permit applicant to be necessary, then TBACT is a CARB or EPA certified engine with a PM certified level (or equivalent emission rate) no greater than 0.1 g/bhp-hr.[1]

A permit applicant may apply alternative and/or additional emissions control (e.g., catalyst-based diesel particulate filters (DPFs), diesel oxidation catalysts, ultra-low sulfur diesel fuel) or other risk reduction measures (e.g., increasing stack height within what is considered Good Engineering Practice, maximizing source/receptor separation distances, modifying operating hours to minimize public exposure) as necessary to reduce risks to acceptable levels specified in one of the two listed criteria above (A or B). All engines not equipped with a DPF must be "plumbed" to facilitate the installation of a DPF at a future date.

Permit applications not meeting one of the above criteria shall be routed to the APCO with a recommendation for denial. The permit engineer shall collect any additional information regarding the project requested by the APCO that will be considered in the risk management process.

FOOTNOTE:

[1] A PM certified level no greater than 0.1 g/bhp-hr means an emission level of 0.15 g/bhp-hr or less as determined during a steady-state engine certification test (ISO 8178).